

occasion to carry back to a distant epoch the place of a star not included in Dr. Danckwott's list. The values of the arcs  $A$ ,  $A'$ , and  $\theta$ , are given for the beginning of every century within the above period. The place of the present Pole-star for the year -2000 is found to be R.A.  $335^{\circ} 10' 0''$ , Decl.  $+67^{\circ} 34' 30''$ .

WE may mention that the formulæ for the reduction of the places of stars to distant epochs are investigated in a very interesting paper by Prof. Schjellerup, which Dr. Copeland and Mr. Dreyer have translated in No. 2 of *Copernicus*, and which the reader who desires to acquaint himself with the application of the rigorous method of taking account of precession should consult.

### PHYSICAL NOTES

THE conducting power of metals for heat and electricity has lately occupied several physicists. Prof. Lorenz of Copenhagen, employing two methods (*Wied. Ann.*, Nos. 7 and 8), gets these results: (1) for the better conducting metals, a confirmation of Wiedemann and Franz's law, that the ratio of the two conductivities, both at  $0^{\circ}$  and at  $100^{\circ}$  is nearly constant; in the inferior conductors it increases much with decreasing conductivity; (2) in all metals except iron, the ratio  $\frac{k_{100}}{k_0}$  is constant, and approximately equal to 1.367 ( $k$  and  $\kappa$  denoting the conductivities for heat and electricity respectively). Thus, for absolute temperature  $T$ ,  $\frac{k}{\kappa} = T \times \text{constant}$ .

A "MEDICAL hydrotelphone," contrived by Prof. Sabatucci (*Riv. Sci. Ind.*) is of the following nature:—Two lead cylinders (5 cm. in diameter and  $\frac{1}{2}$  cm. thick) are closed each with two very fine iron laminae. To the anterior part of each is fitted a wooden mouthpiece (like that of a Bell telephone) connected to a caoutchouc tube, through which one may hear at a distance. The posterior part has a very sensitive electromagnet communicating with a microphone and battery. One tube is applied to either ear. Words or sounds produced before the microphone, and heard but faintly, are rendered intense and distinct by introducing liquid into the cylinders (the less dense the liquid the better). Two sounds may be compared, and their intensity exactly measured, by varying the quantity of the liquid and noting the effects through the tubes. Various applications of the apparatus, in clinical medicine especially, are looked for.

THE effects of lightning on trees placed near a telegraph wire are forcibly illustrated by phenomena lately observed by M. Montigny (*Bull. Belg. Acad.*, No. 7) on a portion of the road from Rochefort to Dinant; which runs from east to west, first on level ground and between poplars for about 1500 metres, then rises gradually 61 metres through woods to a wooded plateau some 200 metres in extent, then comes down to another plain. Of the poplars bordering the road on either side those on the north side, next the telegraph line, have largely suffered, 80 out of 500 having been struck, or about a sixth; those on the other side are very rarely struck. The plain presents only one case, and that doubtful. The instances multiply with increased elevation, and in the wooded plateau on the top reach a maximum (64 per cent.). The most violent discharges have been on the west side of the plateau and rising ground, which is generally first reached by the storms, and the injuries to trees are mostly opposite and under the level of the wire. M. Montigny supposes that while the wire is strongly electrified by induction, the lightning does not strike it, on account of its relative insulation, but strikes the neighbouring poplars directly, which, wet with rain, afford an easier passage for the electric fluid to the ground.

M. PICTET has examined seven varieties of steel (chiefly from a Sheffield and a Vienna house) with regard to magnetic power (*Arch. des Sciences*, August 15). This power he finds to depend on the presence of carbon in the iron, and the aggregation of these substances. One of the two steels giving the best results had  $\frac{3}{4}$ th per cent. of carbon. Samples with  $1\frac{1}{2}$  and  $1\frac{3}{4}$ th per cent. were inferior. German steel of poor quality (for springs) yet made a good magnet; it had little homogeneity, and consisted of an intimate mixture of iron, and iron cemented with a small proportion of carbon. A too-small proportion of carbon suppresses or weakens the remanent magnetism. M. Pictet also finds that the increase of magnetic power in a magnet through the mere presence of the armature in contact is a certain fact for some qualities of steel, but not for all. The first magnetic

passes develop nearly the whole of the remanent magnetism in all artificial magnets. Detachment of the armature by the dynamometer seemed to have no action on the magnetic power, only the slipping of the armature when near rupture must be avoided.

AN experimental inquiry into the production of tones by passage of gases through slits is described by Herr Kohlrausch in *Wiedemann's Annalen* (No. 8). The principal results are these: (1) For all widths of slit between 0.2 mm. and 1 mm. and all densities of gas employed, the pitch  $n$  may be represented as linear function of the velocity of outflow  $u$  by the formula  $n = k(u - u_0)$ , where  $u_0$  and  $k$  are constant for a given width of slit and variety of gas; (2) with increasing width of slit (0.2 mm. to 1 mm.)  $u_0$  decreases,  $k$  increases; (3)  $u_0$  and  $k$  (for air) are as good as independent of the thickness of the slit (*i.e.* the thickness of the brass plates forming it), from 1 mm. to 9 mm.; (4) with increasing density of gas (0.7 to 1.5)  $u_0$  generally decreases,  $k$  increases, *i.e.* the tones, *ceteris paribus*, become higher; (5)  $u_0$  and  $k$  depend in no small measure on other properties of gases besides density; (6) starting from wide slits with constant velocity of outflow, the pitch increases pretty uniformly with narrowing of the slit, reaches a maximum with widths between 0.35 mm. and 0.27 mm.—with thicker slits, smaller pressures, and less dense gases, sooner than in the opposite cases—and then decreases more and more quickly with the width of slit; (7) this maximum pitch characteristic for each velocity of outflow occurs with a greater width of slit, the less the velocity. From a comparison with Strouhal's experiments on the tones excited by motion of cylindrical bodies in air, the author concludes that the production of slit-tones is to be referred to like causes to those of wire-tones.

AN electrophotometer recently described by Dr. Nachs (*La Natura*, August 1) has the following arrangement:—A wooden case opening on one side and above is divided into two compartments, an upper and a lower. The lower contains in the inner part a dry pile of 200 elements, and in the outer a Jacobi rheostat, the cylinder of which has thirty windings (the number introduced into circuit by turning a handle is precisely indicated). The upper compartment has interiorly a galvanometer, and exteriorly an adjustable truncated cone with inner surface blackened, and within it a small selenium cell similar to those used by Bell and Tainter, to receive the light. This cell and the three other electrical instruments are connected by wire. The mode of action will be readily comprehended.

MR. MILNE has observed (*Zeits. f. Kryst.*) that if a suspended quartz ball be allowed to impinge in various ways upon a fixed ball of lime spar, or if the ball of lime spar be placed on a billiard table and the distance observed to which it is driven by the shock, in the former case the quartz ball rebounds furthest, and in the latter the lime spar ball is driven furthest, when the impulse is in the direction of the (crystalline) axes.

IN a paper to the Bremen Society of Natural Science, Herr Müller Erzbach describes experiments in which he sought to ascertain the relative tension of aqueous vapour over saturated solutions of different hygroscopic substances, the inclosed air being submitted for long periods to the action of these. 1. For saturated solutions one finds in the same series, soda, potash, chloride of calcium, an increase in the vapour-tensions, and a decrease in the contractions. 2. Phosphoric acid anhydride, concentrated sulphuric acid, and hydrate of potash deprived of water, present no essential difference in attraction of water. 3. Caustic soda and chloride of calcium, with small proportion of water, differ little in attraction of water, but they do not bind it so firmly as phosphoric acid or hydrate of potash. 4. Hydrate of soda can be completely deprived of water by inclosure with hydrate of potash. 5. The difference in tension of aqueous vapour over the anhydride of phosphoric acid and chloride of calcium nearly without water amounts to only a small fraction of a millimetre of mercury.

THE hypothesis that the luminiferous ether is at rest and the earth moves through it, has been lately put to experimental test by Mr. Michaelson of the U.S. Navy (*Amer. Journ. of Science*, August). Two pencils of light which have travelled over paths at right angles (one path being in the direction of the earth's motion) are permitted to interfere. On rotation of the apparatus  $90^{\circ}$  a measurable displacement, estimated at about one-tenth of the distance between the fringes, might be looked for (the author considered) if the hypothesis of a stationary ether were correct. The apparatus was first tried in the Physical Institute

in Berlin, then, for greater quiet, in the Astrophysicalisches Observatorium at Potsdam (it was very sensitive to vibrations). The interpretation of the results is that there is no displacement of the interference bands, and the hypothesis (which is presupposed in the commonly accepted explanation of aberration) is inferred to be erroneous.

THE expansion of solid sulphur has been studied by S. Scichilone of Palermo, in the case of natural crystals, and of such as had been heated after fusion to  $140^{\circ}$  and  $240^{\circ}$ . The tables (*Wied. Beibl.*, No. 7) show that the expansion depends essentially on the previous heating, inasmuch as different modifications of sulphur are thereby formed. In the first case we have the octahedral sulphur, in another the monoclinic, and in the third a mixture of the latter with that which is not dissolved in sulphide of carbon. In the first two cases the curve representing the volumes as a function of the temperature turns its convex side, in the third its concave side, to the axis of temperature.

### GEOLOGICAL NOTES

THE recent geological exploration of the shores of Lake Baikal by M. Tchersky has been fruitful of important results for science. The rocks of which the mountains on the western shore are built up belong to three different ages: pre-Silurian (probably Laurentian), Silurian, and Jurassic. The Laurentian rocks afford several foldings running north-east, which enclosed basins of Silurian and Jurassic seas; as to recent formations they are only freshwater ones, and belong to the Tertiary and Post-pliocene; these last, which are remains of several smaller lakes, are found at a great height above the level of Lake Baikal. M. Tchersky's geological researches confirm the suggestion which was made several years ago on geographical grounds by M. Kropotkin, namely, that, like several other lakes, Lake Baikal consists of two longitudinal valleys, connected together in the middle part of the actual basin.

THE important coal-basin of the Don province of Russia has not hitherto been explored with accuracy. During last summer M. Domger undertook a thorough exploration of this interesting geological region, and, as we learn from a communication he has made at the December meeting of the St. Petersburg Mineralogical Society, his researches have led to important discoveries. Thus he discovered a great variety of crystalline rocks, porphyries, &c., and volcanic ores, within the coal-measures, which discovery thus extends the crystalline island of Southern Russia far eastwards as a strip about 500 miles long, which runs from north-west to south-east. At the same meeting the Society awarded its gold medal to M. Romanoffsky for his researches in Turkestan.

M. DOKOUCHAIEFF's researches on the soils of Russia seem to establish a very interesting fact as to the distribution of black-earth. The typical black-earth occupies an elongated zone directed from south-west to north-east from Kishineff, through Kharkoff, Voronezh, Simbirsk, to Bougoulina in the province of Oufa; in this zone the black-earth contains from 7 to 12 per cent. of humus, and from both sides to north-west and south-east it is accompanied by two other elongated zones, where the black-earth contains only 5 to 7 per cent. of humus, whilst the other parts of Russia afford only sporadic spots of black-earth.

M. MOUSHKETOFF's paper on the glacier of Zerafshan, which appeared in a recent number of the *Izvestia* of the Russian Geographical Society, contains further details about the expedition which has explored the glacier throughout its whole length, from its lower extremity to the sixteen miles distant and 13,800 feet high pass of Matcha, whence another glacier, that of the Zardala river, descends on the north-eastern slope for 2200 feet, by a series of mighty icefalls. The paper is accompanied with a pretty map which shows this grand ice-world, where no less than thirteen secondary glaciers are feeding the ice-stream of the Zerafshan. We notice in this paper that formerly the Zerafshan glacier descended far lower than now. M. Moushketoff says that thirty-three miles below its actual extremity, namely, at the village Diaminor, there is a beautiful terminal-moraine which crosses the valley and unites with three longitudinal moraines. Immense boulders, thirty-five and forty feet in diameter, and consisting of granite, syenite, and gabbro, cover the whole space between these old moraines and the actual ones, so that there cannot be the least doubt as to the glacier having descended

for at least thirty-three miles lower than now. But when we see how the composition of the drift changes lower down in the valley, the loess, which is the wealth of the inhabitants in the lower countries, changing into mighty conglomerates with immense boulders, we are much inclined to think, that the former glaciers descended yet far lower. Therefore we observe with some regret that M. Moushketoff gives too little attention to the diluvial formations of the Upper Zerafshan and to their relations to the loess.

### GEOGRAPHICAL NOTES

WHEN Humboldt determined for the first time the average heights of continents, he could not, because of the want of data, determine that of Africa. Now Dr. Chavanne publishes, in the *Proceedings* of the Geographical Society of Vienna (vol. xxiv.), an elaborate paper on this subject, accompanied with a hypsometrical map of the African continent, which is based on no less than 8000 hypsometrical measurements. After a thorough discussion of the relative value of various measurements, Dr. Chavanne discusses the average heights of separate parts of Africa, and by how much each of them would raise the continent if its mass were distributed over the whole of the surface of Africa. He finds that the Atlas Mountains, if distributed over the surface of Africa, would produce an elevation of 26 metres; the Sahara, 122 metres; the plateaux of Soudan, 85 metres; those of Central and South Africa, 129 metres; and so on; and he accepts for the average height of the whole of the continent no less than 661.8 metres (with a probable error of  $\pm 21$  metres), which figure he considers to be rather below the truth. This very high figure obviously is the result of the very great extension of high plateaux, which we do not find to such an extent even in Asia.

IN the Annual Report of the Surveyor-General of India, which, though it has been printed for months, has only just been allowed to appear, prominence is given, under the heading of Trans-Frontier Exploration, to an attempt to determine the position of the head-waters of the Irrawaddy by Capt. J. E. Sandeman, through the agency of a native surveyor whom he had trained in imitation of the late Col. T. G. Montgomerie's renowned staff in India. This surveyor alleges that he ascended the river to Mogung-poon, near the point where it divides into two great branches, the Malee and Mehka. The surveyor, we believe, gives as an explanation of his not having prosecuted his journey to a more successful termination, that he was attacked and robbed by wild tribes; but we hear privately that persons in Burma, well qualified to form an opinion, attach little credit to any of the surveyor's statements, and we fear, therefore, that the position of the head-waters of the Irrawaddy is still an unsolved problem.

THE Geographical Society of the Pacific is the title of a new Society formed at San Francisco. The Secretary is C. Mitchell Grant, F.R.G.S. The objects of the Society, it is stated, are to encourage geographical exploration and discovery; to investigate and disseminate geographical information by discussion, lectures, and publications; to establish in the chief city of the Pacific States, for the benefit of commerce, navigation, and the industrial and material interests of the Pacific Slope, a place where the means will be afforded of obtaining accurate information, not only of the countries bordering on the Pacific Ocean, but of every part of the habitable globe; to accumulate a library of the best books on geography, history, and statistics; to make a collection of the most recent maps and charts, especially those which relate to the Pacific coasts, the islands of the Pacific, and the Pacific Ocean; and to enter into correspondence with scientific and learned societies whose objects include or sympathise with geography. The Society will publish a *Bulletin* and an annual *Journal*.

WE learn from the Annual Report for 1880-1881 of the Swiss correspondent of the Geographical Society of Vienna that the following geodetical and geological work was done in Switzerland:—The Geodetical Commission has published the seventh fascicule of the "Nivellement de Précision de la Suisse," which contains the measurements done during the years 1877 to 1879 on the lines of Monte Cenero to Chiasso, Reichenau to Sargans and Andermatt, and Süss to Landquart and Chiavenna, uniting thus the Swiss measurements with the Italian ones. The Geological Commission publishes the fourth volume of its new series, containing the important work, by Dr. Balzer,